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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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SEPTEMBER, 1917

The Chenopodiaceae of the North American Flora

PAUL CARPENTER STANDLEY*

The North American Chenopodiaceae have been treated previously in two monographic accounts. The first of these was that of Moquin-Tandon in De Candolle's Prodromus,† published in 1849. Moquin had access to a very limited number of specimens, for at that time scarcely any collections had been made in the western United States and northern Mexico, the parts of the continent in which the family is most extensively represented. The other monograph of the North American species, by Watson, appeared in 1874.‡ The latter author had the advantage of fairly ample collections, and his monograph is very useful even now, although many additional species have been described in recent years. Watson enumerated 83 species; the present writer, in the treatment of the family for the North American Flora,§ has recognized 223. The great increase in number of species in the last forty years is due partly, of course, to a different conception of specific limits, but chiefly to more extensive exploration. Several European and South American species have become naturalized only in comparatively recent years. It is not probable that the present number will be greatly increased unless from parts of Mexico still unexplored.

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† 13^2: 41–219. 1849.

‡ Proc. Amer. Acad. 9: 82–126. 1874.

§ 21: 3–93. 27 N 1916.

[The BULLETIN for August (44: 369–410) was issued August 10, 1917.]

This family is not an easy one for study, especially because of the great individual variation frequently found within a species. It is often extremely difficult to decide where specific lines should be drawn, consequently it will be many years before all American botanists agree upon a classification. Such a condition is not peculiar to the Chenopodiaceae, but it does seem more characteristic of this family than of some of the closely related ones, such, for instance, as the Amaranthaceae, in which the species are clearly defined.

The present notes are intended to explain some of the more important changes in nomenclature which the writer has found necessary, as well as to illustrate by citation of specimens the material upon which some of the new species are based. In the case of new species founded upon a single collection, no comments seem necessary, the basis of segregation being explained sufficiently by the keys. In the course of the preparation of the account of the family, the writer examined, besides the material in the United States National Herbarium, all that in the Gray Herbarium and the herbaria of the New York Botanical Garden and the Missouri Botanical Garden. Certain material was lent, also, from the herbaria of the Field Museum of Natural History, the University of California, and Professor W. L. Jepson.

CHENOPODIUM L.

In none of the genera of the Chenopodiaceae are the species quite so perplexing as in *Chenopodium*, particularly in the group of *C. album* L. and its allies. This applies not only to the species of eastern North America, which are mostly adventive from Europe, but also to the western ones, which are endemic. The chief character relied upon for specific segregation has generally been leaf form, which, in any group of flowering plants, is seldom by itself a satisfactory criterion of species. In the present instance it is doubtless the best character available, at least in the case of the European species.

In Europe much attention has been devoted in recent years to a study of *Chenopodium*, a study based not only upon large series of herbarium specimens, but also upon cultivated pedigreed plants.

As a result an almost endless number of forms have been described and named. Many of these minor forms occur in North America, and any one who is interested in their segregation could find here an almost unlimited field for investigation. To the writer, however, most of the forms recognized abroad seem to be based upon such slight and inconstant characters that they scarcely deserve serious consideration, especially in America, where the flora as a whole is still so imperfectly known.

In Europe, too, many presumed hybrids have been described, not only hybrids between species but even between hybrids. Most of these are known only from cultivated plants. If hybridization is a common phenomenon in the genus it may well explain, partially at least, the obstacles to the determination of specific limits. It is unfortunately true that the North American species are still but poorly understood, and that a wholly satisfactory arrangement of them is apparently not to be secured at present.

CHENOPODIUM PALLESCENS Standley, N. Amer. Fl. **21**: 15. 1916

The plants referred to this species have passed as *C. leptophyllum* Nutt. and *C. subglabrum* (S. Wats.) A. Nels. They are most like the latter species in pubescence and habit, but are distinguished from both by having the pericarp firmly attached to the seed. The following specimens have been seen:

MISSOURI: Allenton, on stony hills, August 30, 1887, *Eggert;* near Pacific, *Eggert;* Webb City, *E. J. Palmer 1041;* Sheffield, *Bush 553.* OKLAHOMA: Lincoln County, 1895, *Blankinship;* Sapulpa, *Bush 489.* TEXAS: Dallas County, *Reverchon 818.* NEW MEXICO: Roswell, *Earle 326* (type).

CHENOPODIUM INAMOENUM Standley, N. Amer. Fl. **21**: 15. 1916

Although closely related to *C. leptophyllum*, which it resembles in general appearance, this species has the pericarp adherent to the seed, instead of free. It has a wide range, as shown by the following list of specimens examined.

OREGON: P Ranch, *Griffiths & Hunter 281.* MONTANA: Horr, *Mearns 3318.* WYOMING: Bitter Creek, Sweetwater County, *A. Nelson 3704a.* UTAH: Henry Mountains, *Jones 5695bi.* NEVADA: Ely, *A. E. Hitchcock 1237.* ARIZONA: Nagle's Ranch,

Jones 6050f. NEW MEXICO: Mangas Springs, 1903, *Metcalfe;* Farmington, *Standley 7101.* CHIHUAHUA: near White Water, *Mearns 2286* (type).

CHENOPODIUM HIANS Standley, N. Amer. Fl. **21**: 16. 1916

Of the group of *C. leptophyllum*, but distinguished from all the related species by its ill-scented foliage. This character, which has been ignored heretofore, seems to be a very good one. The European *C. Vulvaria* L. has always been noted for its diagreeable odor, and several American species possess the same character. Their odor is quite different from that of *C. ambrosioides* L. and its allies. The type of *C. hians* was collected near Dulce, New Mexico (*Standley 8129*) and the species has been obtained by the writer at Ensenada (No. 10764) and Ute Park in the same state. A specimen from Bear Creek, near Eagle Peak, Wyoming, collected by Schuchert, is also referable here. The species is distinguished, also, by the erect calyx, which does not embrace the fruit closely as in related species.

CHENOPODIUM CYCLOIDES A. Nels. Bot. Gaz. **34**: 363. 1902

The original collection, from Grant County, Kansas, is too immature to show the true characters of this species and might at first glance be referred to *C. leptophyllum* Nutt. The only other locality known for the plant is on sandhills in Dona Ana County, New Mexico, where it is abundant, according to Mr. E. O. Wooton, who has obtained excellent and ample specimens at two different times. The species is distinguished from all those of the *C. leptophyllum* group by its calyx, almost rotate at maturity and with ecarinate lobes, and by its bright red pericarp. Indeed, the general appearance of the mature plant does not at first remind one of the genus *Chenopodium.*

CHENOPODIUM NEVADENSE Standley, N. Amer. Fl. **21**: 16. 1916

A relative of *C. atrovirens* Rydb., but distinguished by having the seed adherent to the pericarp, and by the small leaves and seeds. The type is from Winnemucca Lake, Nevada (*Kennedy 1903*). Shockley's No. 542 from Candelaria also belongs here, besides one or two other Nevada collections examined.

CHENOPODIUM PRINGLEI Standley, N. Amer. Fl. **21**: 18. 1916

Allied to *C. Fremonti* S. Wats., to which the specimens have been referred, but distinguished by the form of the leaf blades, which are coarsely sinuate-dentate and only slightly lobed. In *C. Fremonti* the well-developed lobes are usually entire, at least the large terminal one. The type of *C. Pringlei* was collected near Dublán, Hidalgo, Mexico (*Pringle 9283*). Pringle's No. 6570 from Tule, Hidalgo, is the same species.

CHENOPODIUM NEOMEXICANUM Standley, N. Amer. Fl. **21**: 19. 1916

Related to *C. Fremonti* S. Wats., but differing in the adherent pericarp. The type was collected along Mineral Creek, Sierra County, New Mexico, by O. B. Metcalfe (No. 1413), and the species has been collected in the Chiricahua Mountains of Arizona by J. C. Blumer (No. 1409).

CHENOPODIUM ARIZONICUM Standley, N. Amer. Fl. **21**: 19. 1916

A segregate from *C. Fremonti*, distinguished primarily by having the pericarp adherent to the seed. It is distinct from *C. neomexicanum* in the size of the seed, scarcely more than half as large as in the latter. The following specimens have been seen:

ARIZONA: Santa Rita Forest Reserve, *Griffiths 5982* (type); Santa Rita Mountains, *Griffiths 6011;* near Tucson, 1911, *Wooton;* Rincon Mountains, *Blumer 3585*.

CHENOPODIUM AMARANTICOLOR Coste & Reynier, Bull. Soc. Bot. France **54**: 181. 1907

A species not reported previously from North America. It is a relative of *C. album* L., from which it is distinguished by its broad leaf blades and the red coloration of the upper leaves and inflorescence. Specimens from Thomasville, Georgia (*E. B. Taylor*, 1909) and Santiago de las Vegas, Cuba (*Abarca 2794*), are referred here. The native habitat of the plant is not known, but it has been found as a weed in France. It is sometimes cultivated as a foliage plant.

CHENOPODIUM VIRIDE L. Sp. Pl. 219. 1753

Chenopodium opulifolium Schrad.; Koch & Ziz, Cat. Pl. Palat. 6. 1814.

This is a well-known Old World species which generally has been known as *C. opulifolium*. *C. viride* L., however, was based upon a plate which evidently represents the same plant. The Linnaean name has been applied usually to the plant which is properly known as *C. paganum* Reichenb. So far as the writer knows, *C. viride*, in the sense in which the name is used here, has never been reported from North America, but the rather numerous collections cited below should all be referred to it. It differs from *C. album*, with which American specimens have been confused, in having the blades of the lower leaves as broad as long and, when dry at least, of a peculiar bluish-green color.

ONTARIO: Ottawa, *Macoun 5872;* Sandwich, *Macoun 54723*. RHODE ISLAND: Providence, July 31, 1892, *J. F. Collins*. MARYLAND: Cumberland, September 12, 1898, *Steele*. ILLINOIS: East St. Louis, September, 1894, *Eggert;* Rockford, 1880, *Bebb;* Mt. Carmel, July 12, 1894, *Schneck*. MISSOURI: Joplin, *Bush 2041*. TEXAS: Big Springs, June 11, 1900, *Eggert*.

CHENOPODIUM DACOTICUM Standley, N. Amer. Fl. **21**: 22. 1916

This species is related to *C. album* and *C. ferulatum* Lunell, but appears sufficiently distinct in the very coarse, loose pubescence, ill-scented foliage, and coarsely punctate seeds. The following specimens are in the National Herbarium:

SOUTH DAKOTA: Cedar Pass, *Over 6175* (type); Fall River Falls, *Rydberg* 964; Talus slopes, badlands, Washington County, August 4, 1914, *Over;* summit of Sheep Mountain, Pennington County, August 20, 1914, *Over;* badlands near White River, August 1, 1914, *Over;* White River, *Over 6211*.

The same plant apparently, doubtless adventive, has been collected in waste ground at Courtney and Sheffield, Missouri, by B. F. Bush (Nos. 7058A, 7066).

CHENOPODIUM PETIOLARE H. B. K. Nov. Gen. & Sp. **2**: 191. 1817

North American botanists have overlooked this species, but in Europe it has been generally recognized in recent years, and North

American material has been referred to it by European writers. It has been confused with *C. album*, to which it is very closely related, differing chiefly in the deeply lobed blades of the upper leaves, and the dull rather than lustrous seeds. It is widely distributed in the Southwest. Some of the numerous collections at hand are cited below.

COLORADO: Durango, *Baker, Earle, & Tracy 487*. NEW MEXICO: between Santa Fe and Canyoncito, *Heller 3787;* Chama, *Standley 6515;* Ensenada, *Standley & Bollman 11097;* Mangas Springs, *Metcalfe 216;* Mesilla, *Wooton 85*. ARIZONA: Willow Spring, *Palmer 586;* Flagstaff, July 3, 1891, *MacDougal*. NEVADA: Truckee Valley, *Bailey 969*. CALIFORNIA: Cameron's Ranch, *Schoenfeldt 3682;* Panamint Mountains, *Coville & Funston 813*.

CHENOPODIUM ARISTATUM L. Sp. Pl. 221. 1753

This is known definitely to occur in Siberia, but whether it is found in North America is still doubtful. It has been reported from Alaska and Mexico, and it is reasonable to expect it in Alaska, although none of the numerous collectors who have visited that region in recent years have found it. The occurrence of the species in Mexico seems very doubtful. The plant is so distinct that it scarcely seems probable that any other species would be mistaken for it. There is always the possibility of a misplaced label as an explanation of an otherwise inexplicable extension of range.

CHENOPODIUM INCISUM Poir.; Lamarck, Encyc. Suppl. 1: 392. 1810

?*Chenopodium graveolens* Lag. & Rodr. Anal. Ci. Nat. 5: 70. 1802.
Teloxys cornuta Torr. Pacif. R. R. Rep. 4: 129. 1857.
Chenopodium cornutum Benth. & Hook.; S. Wats. Bot. Calif. 2: 482. 1880.

Chenopodium incisum has a wide range, extending from southern Colorado, through Mexico and Central America, to South America, besides occurring in Africa. Probably it should be known as *C. graveolens* Lag. & Rodr., but the data afforded by the original publication of that species are insufficient for certainty. The plant of the United States has been known generally as *C.*

cornutum, but it differs in no way from the mass of Mexican material. Tropical forms have been referred commonly to *C. foetidum* Schrad., a different plant of which the writer has seen no North American specimens.

CHENOPODIUM DISSECTUM (Moq.) Standley, N. Amer. Fl. **21**: 26. 1916

Ambrina dissecta Moq. Chenop. Enum. 38. 1840.

Apparently this is a very rare plant. Before seeing material of it the writer presumed, from Moquin's description, that it was only a form of *C. incisum*. It is, however, quite distinct, being more closely related to *C. Botrys* L., as was apparent when the two following collections were discovered, both of which agree perfectly with the original description.

MEXICO: Saltillo, 1898, *Palmer 353;* Valley of Mexico, *Schaffner 437*.

CHENOPODIUM VAGANS Standley, N. Amer. Fl. **21**: 26. 1916

Chenopodium chilense Schrad. Ind. Sem. Hort. Gotting. **1832**: 2. 1832; Linnaea **8** (Litt.-Ber.): 25. 1833. Not *C. chilense* Pers. 1805.

Although most of the segregates from *C. ambrosioides* are too poorly marked to deserve specific rank, the one to which the above names have been applied seems to be an exception. It has apparently been overlooked by American botanists, the collections at hand having been identified mostly as *C. anthelminticum* L. *C. vagans* differs from all the forms of *C. ambrosioides* in its white-villous stems and in the conspicuously dentate or sinuate-pinnatifid leaves of the inflorescence. In fruit the plants have a characteristic appearance because of the very numerous, much elongate, slender spikes. The species is a native of Chile, and probably is adventive in California. The following specimens have been examined:

CALIFORNIA: Clinton, *Hansen 2020;* Ione, *Braunton 1185;* Tehama, *Ward 101;* Ukiah, *Chestnut 349;* North Fork, *Griffiths 4648;* Mendocino, *H. E. Brown 949;* Crystal Springs, *Elmer 4134;* without locality, 1860–67, *Rattan*.

A specimen "Ex Herb. E. & C. Faxon" collected at Boston,

Massachusetts, in 1878, is probably *C. vagans*, but the plant is too young for definite determination.

CHENOPODIUM AMBROSIOIDES L. Sp. Pl. 219. 1753

This species, a native, presumably, of tropical America, is now widely diffused through the tropics of both hemispheres, and is naturalized in many regions far outside the tropics, especially in North America. As a consequence of its extensive range it exhibits much variation, but none of the forms seem worthy of specific recognition and few of them of rank as subspecies. *C. anthelminticum* L., which has been recognized in most North American manuals as a species or subspecies, does not seem to be worthy nomenclatural recognition. It is apparently nothing more than a poorly marked seasonal variation.

CHENOPODIUM FARINOSUM (S. Wats.) Standley, N. Amer. Fl. **21**: 28. 1916

Chenopodium murale farinosum S. Wats. Proc. Amer. Acad. **9**: 97. 1874.

Although described as a variety of *C. murale* L., this plant is far removed from that species and finds its nearest ally in *C. glaucum* L., differing from the latter in its large size and large glabrate leaves. In North America it seems to be confined to California, but, like some other Californian plants, it occurs also in western South America and in Paraguay. The following collections are representative:

CALIFORNIA: without locality, 1853–56, *C. Wright;* Santa Cruz Mountains, *A. E. Hitchcock 183;* Nigger Slough, Los Angeles County, *Braunton 558;* San Francisco, *Bolander 2489* (type).

CHENOPODIUM SALINUM Standley, N. Amer. Fl. **21**: 29. 1916

The above name is proposed for the native North American plant which has been referred to the Old World *C. glaucum*. The latter is rather sparsely adventive from New Brunswick to Virginia and as far west as Nebraska. *C. salinum* ranges from Manitoba and Alberta to New Mexico and Arizona, and has been collected in Missouri, where, doubtless, it is adventive. The North American plant has stout, dense, short, mostly axillary spikes of flowers,

with sparsely villous rachises, and finely tuberculate seeds; the European plant has slender, elongate, interrupted, axillary and terminal spikes with glabrous rachises, and smooth seeds. While the differences may not seem very great, they are easily recognized when the two forms are compared. There seem to be no intermediate plants.

BLITUM L.

BLITUM VIRGATUM L. Sp. Pl. 4. 1753

An Old World species, closely related to *B. capitatum* L., but distinguished by the leafy rather than naked inflorescence, obtuse margin of the seeds, and copiously branched stems. It has escaped recognition by American botanists, but specimens in various herbaria were collected long ago in Massachusetts and New York, probably mere waifs. It seems to have become naturalized in the Northwest, having been found in Washington (Pullman, 1900, *Piper*), Oregon (Wallowa Mountains, 1897, *Sheldon 8846*), and Idaho (Ketchum, 1911, *Nelson & Macbride*).

ATRIPLEX L.

ATRIPLEX HASTATA L. Sp. Pl. 1053. 1753

Chenopodium subspicatum Nutt. Gen. 1: 199. 1818.
Atriplex lapathifolia Rydb. Mem. N. Y. Bot. Gard. 1: 133. 1900.
Atriplex carnosa A. Nels. Bot. Gaz. 34: 361. 1902.

Recent writers upon the botany of the western United States have insisted that the plants of the Rocky Mountain and adjacent regions previously referred to *A. hastata* were distinct from the beach or salt marsh plant of the Atlantic and Pacific coasts. Their conclusions must have resulted from the paucity of eastern material for comparison. In the large series of northeastern specimens in the herbarium of the New England Botanical Club all the Rocky Mountain forms can be matched without difficulty; and it is easy to find European specimens, also, which agree in essential characters. In Europe names have been given to all the easily recognizable variations, and it would be possible to find American plants referable to many of the European forms. These, however, are based upon too inconsequential characters to deserve attention.

Probably it will never be possible for all botanists to agree upon a treatment of the species of *Atriplex* of the *A. hastata* alliance, and in the past both European and American authors have held widely divergent views as to specific limits within the group. The present writer has recognized eight species in North America, namely: *A. drymarioides* Standley, known from a single Alaskan collection; *A. zosteraefolia* (Hook.) S. Wats., of Washington; *A. alaskensis* S. Wats.; *A. Gmelini* C. A. Mey., ranging from northern California to Alaska; *A. joaquiniana* A. Nels., occurring from British Columbia to central California; *A. littoralis* L., *A. patula* L., and *A. hastata* L. All of these, except the first three, are closely related and are distinguished by comparatively slight variations. *A. Gmelini* and *A. joaquiniana* are probably sufficiently distinct. Of the last three, *A. littoralis* is doubtless the "strongest" species and when properly limited is easily recognized by its linear leaf blades and erect habit. The only American specimens seen that are referable to it are from the coast of Maine, except a few found as waifs in the vicinity of Philadelphia. Both *A. patula* and *A. hastata* seem to the writer to deserve specific rank. While no sharp line can be found to separate the multitudinous forms which are referable to them, the typical form of each represents a well-marked center of variation, which seems to merit more than subordinate rank.

ATRIPLEX ROSEA L. Sp. Pl. ed. 2. 1493. 1763

Atriplex spatiosa A. Nels. Bot. Gaz. **34**: 360. 1902.

Although this Old World species has been found along the Atlantic Coast from New York to Florida, it is probably nowhere in this area more than a waif. In the west, however, its status is very different, for although it seems to have been introduced only recently, it has spread with amazing rapidity, its present known range extending from Washington to South Dakota, southern California, and northern Chihuahua. In many parts of its western range it is extremely abundant, so much so that in places it has been cut for hay. In parts of New Mexico it has every appearance of being a native plant, occurring in abundance many miles from a railroad. Its case is somewhat comparable to that of the Russian thistle, a European plant which for some un-

known reason has found conditions in America particularly favorable for its spread. In the present instance, however, there seems to be no great harm involved, and the plant may even be beneficial if it is useful as forage. Probably within a few years it will have spread throughout the Great Plains region and the territory westward to the Pacific Coast.

The oldest western specimens in the National Herbarium were collected in Wyoming in 1897. The first Oregon specimens were obtained in 1901, and all those from other western states still later.

ATRIPLEX SACCARIA S. Wats. Proc. Amer. Acad. **9**: 112. 1874

Atriplex cornuta Jones, Proc. Calif. Acad. II. **5**: 718. 1895.

Among North American species this is remarkable in having strongly dimorphous fruiting bracts. In certain other species also the bracts vary greatly upon a given plant, but in none, except the abnormal *A. hortensis* L. and its allies, do these parts exhibit such striking variation as in *A. saccaria*. The name *saccaria* has been ignored by recent writers upon western plants. It was based upon specimens showing only the small fruiting bracts (the large ones had fallen off, doubtless); hence it is not remarkable that the species has been wrongly identified from the description, and that Mr. Jones once regarded it as a variety of *A. truncata* (Torr.) A. Gray.

ATRIPLEX SORDIDA Standley, N. Amer. Fl. **21**: 47. 1916

Of the *A. argentea* group, differing from that species in the sessile, wholly alternate leaves, and from *A. expansa* S. Wats. in the terete branches, coarse and loose pubescence, and smaller seed. The type was collected in the San Jacinto Valley, California, in 1880, by G. R. Vasey (No. 549). A collection from Santa Monica, California (*Parish 1124*), also belongs here.

ATRIPLEX MOHAVENSIS (Jones) Standley, N. Amer. Fl. **21**: 47. 1916

Atriplex expansa mohavensis Jones, Contr. West. Bot. **11**: 20. 1903.

This name applies to the common plant of central and southern California which has passed as *A. expansa* S. Wats. The latter,

however, is restricted to the Rio Grande Valley of southern New Mexico, western Texas, and northeastern Chihuahua. The bracts of the Californian plant are sufficiently distinct to entitle it to specific rank, and the ranges of the two species are widely separated.

ATRIPLEX HILLMANI (Jones) Standley, N. Amer. Fl. **21**: 48. 1916

Atriplex argentea Hillmani Jones, Contr. West. Bot. **11**: 21. 1903.

This plant seems to have a limited distribution, being confined to Nevada and southeastern Oregon, so far as specimens show. It differs conspicuously from *A. argentea* in the form of the bracts and leaf blades. Representative collections are the following:

OREGON: Malheur, &c., *Cusick 1263*. NEVADA: Leonard Creek Ranch, *Griffiths & Morris 346;* Battle Mountain, *Kennedy 4001, A. E. Hitchcock 586;* Lemmon Valley, *Kennedy 2081*.

ATRIPLEX MINUSCULA Standley, N. Amer. Fl. **21**: 51. 1916

Most closely related to *A. pusilla* (Torr.) S. Wats., a species of eastern Oregon and northwestern Nevada, from which it is distinguished by its larger bracts, these subhastate and denticulate or crenulate, not ovate and entire. The following collections have been observed:

CALIFORNIA: between Tulare and Tulare Lake, 1892, *Palmer 2728* (type); Laton, *Kearney 33, 34;* near Poso, *Coville & Funston 1249;* without locality, 1872, *Torrey*.

ATRIPLEX PENTANDRA (Jacq.) Standley, N. Amer. Fl. **21**: 54. 1916

Axyris pentandra Jacq. Sel. Stirp. Amer. 244. 1763.
Atriplex cristata Humb. & Bonpl.; Willd. Sp. Pl. **4**: 959. 1806.

In view of the fact that this plant was first described as a species of the Old World genus *Axyris*, it is perhaps not remarkable that its earliest name has been so long overlooked. More probably it has been neglected because its identity can be confirmed only by a consultation of Jacquin's illustration, which occurs in one of the rarest of botanical works.* This shows that the name *Axyris pentandra* applies to the common plant of southern Florida and the West Indies, heretofore known as *Atriplex cristata*.

* Sel. Stirp. Amer. Pict. *pl. 235*. 1763.

ATRIPLEX GLOMERATA S. Wats.; Standley, N. Amer. Fl. **21**: 54. 1916

Founded upon Palmer's No. 1156, collected at Parrás, Coahuila, in 1880. The type specimen, in the United States National Herbarium, bears the previously unpublished name cited above. The plant is related to the Mexican *A. muricata* Humb. & Bonpl., but differs in having unappendaged bracts. Two additional collections belong here:

MEXICO: Coahuila, *Rose 3075;* Buena Vista, *Gregg 349.*

ATRIPLEX DAVIDSONII Standley, N. Amer. Fl. **21**: 57. 1916

This name is proposed for a plant closely related to *A. pacifica* A. Nels. (*A. microcarpa* [Benth.] D. Dietr.) and *A. Coulteri* (Moq.) D. Dietr., but distinguished from both by its dentate leaf blades. In the form of its staminate inflorescence it is intermediate between those two species. The following collections have been examined:

CALIFORNIA: Balboa, *Davidson 2951* (type); Long Beach, *W. F. Parish;* Los Angeles, *Braunton 680;* in 1884, *Nevin;* Colton, *Parry 287.*

ATRIPLEX SONORAE Standley, N. Amer. Fl. **21**: 62. 1916

An ally of the Mexican *A. Barclayana* (Benth.) D. Dietr., but separated by the very different fruiting bracts, these being united only to the middle, their margins green and deeply laciniate, and their sides sharply muricate. The following collections belong here:

SONORA: Empalme, *Rose, Standley, & Russell 12631* (type); Guaymas, *Palmer 671, 672, 673, 674, 677, 690.* SINALOA: Altata, November, 1899, *Brandegee.*

ATRIPLEX POLYCARPA (Torr.) S. Wats. Proc. Amer. Acad. **9**: 117. 1874

Atriplex curvidens Brandeg. Proc. Calif. Acad. II. **2**: 201. 1889.

The type of *A. curvidens*, in the herbarium of the University of California, has been examined by the writer through the kindness of Professor H. M. Hall. It exhibits certain differences from typical *A. polycarpa*, but none that are constant. The stems and bracts are attacked by a fungus, probably a rust, and

it is suspected that the specimen is an abnormal one, deformed by the parasite.

ATRIPLEX OBOVATA Moq. Chenop. Enum. 61. 1840

Atriplex Greggii S. Wats. Proc. Amer. Acad. **9**: 118. 1874.

When Watson prepared his account of the North American Chenopodiaceae he seems to have overlooked Moquin's name. The type collection of *A. obovata*, obtained by Berlandier, was cited by Watson under his new species *A. Greggii*. *Atriplex Jonesii* Standley (*A. sabulosa* Jones, 1903, not Rouy, 1890) is very close to *A. obovata* and should, perhaps, be regarded as only a form of it. The two seem, however, to have separate ranges.

ATRIPLEX GARDNERI (Moq.) Standley, N. Amer. Fl. **21**: 66. 1916

Obione Gardneri Moq.; De Candolle, Prodr. **13**^{2}: 114. 1849.
Atriplex Gordoni Hook. Jour. Bot. & Kew Misc. **5**: 261. 1853.
Atriplex eremicola Osterhout, Bull. Torrey Club **25**: 284. 1898.

The name *Obione Gardneri* has been neglected by all American botanists, possibly because of an impression that the plant was of South American origin. The type locality is given by Moquin as "Ad La Platte," and the collector as Gardner. Hooker, however (*loc. cit.*), pointed out that the specimen was really obtained by Gordon along the Platte River in North America. A fragment of the original collection (*Gordon 251*) in the Gray Herbarium shows that it is the same as the plant described by Osterhout as *Atriplex eremicola*. Since Moquin never changed the specific name first applied, the present writer prefers to maintain it in its original form.

ATRIPLEX CANESCENS (Pursh) Nutt. Gen. **1**: 197. 1818

The authority usually given for the above combination is James, but this is incorrect. Nuttall first made the combination *Atriplex canescens* (based on *Calligonum canescens* Pursh), and although he described a different plant at the time he made the transfer of name, he must be credited with the authorship of the binomial.

The species has an unusually wide range and shows very appreciable variation in almost every character. The extensive

series of specimens in the National Herbarium indicates, however, that it is impossible to recognize any of the several segregates that have been proposed. Locally some of the forms appear distinct enough, but when the whole series of specimens is examined all shades of intergradient forms are found.

ENDOLEPIS

ENDOLEPIS COVILLEI Standley, N. Amer. Fl. **21**: 73. 1916

Atriplex phyllostegia S. Wats. Proc. Amer. Acad. **9**: 108. 1874 (in part). Not *Obione phyllostegia* Torr. 1871.

Endolepis phyllostegia Rydb. Bull. Torrey Club **39**: 312. 1912 (in part).

It is remarkable that a plant so distinct and apparently far from rare has been left so long unnamed, but the explanation is found in the fact that Watson confused it with a quite different plant, a true *Atriplex*. The original collection of *Obione phyllostegia* consists of immature and poorly prepared specimens, which, it now appears, are those of a presumably rare species renamed by Jones as *Atriplex Draconis*.* Because of the unsatisfactory material at his disposal, it is not surprising that Watson should have considered the Californian plants the same as *Obione phyllostegia*, and that consequently he should have drawn his description of *Atriplex phyllostegia* from them, chiefly. Probably as a result of this description Jones was led to describe his new species, *Atriplex Draconis*, and Rydberg, later on, to transfer *Atriplex phyllostegia* to the genus *Endolepis*.

SALICORNIA L.

SALICORNIA FRUTICOSA L. Sp. Pl. ed. 2. 5. 1762

Apparently referable here is a specimen from Cameron, Louisiana, collected by W. L. McAtee in 1910 (No. 1916), as well as Nash & Taylor's No. 1122 from Inagua, Bahamas. *S. fruticosa* is a well-known Old World species, occurring in southern Europe, western Asia, Africa, and Polynesia. It is distinguished from *S. perennis* Mill. by the short, conic hairs upon the seeds.

The common perennial *Salicornia* of the Atlantic and Gulf

* Contr. West. Bot. **8**: 40. 1898.

Coasts of North America and of the West Indies was referred by early writers upon American botany to *Salicornia fruticosa* L. In recent years all American botanists, following, apparently, the statements made by Watson in 1874,* have recognized the American plant as a distinct species under the name *S. ambigua* Michx. The present writer, however, can find no character by which to distinguish *S. ambigua* from *S. perennis*, a common Old World plant, and the one which formerly passed as *S. fruticosa* L. Watson stated that the American plant had pubescent seeds and the European glabrous ones, but in making this comparison the European plant he really had in mind was not the Linnaean species, in its proper sense, but a plant now known as *Arthrocnemum glaucum* (Delile) Ung. Sternb.

SALICORNIA DEPRESSA Standley, N. Amer. Fl. **21**: 85. 1916

An annual plant of southern California, distinguished from *S. europaea* L., as well as from *S. rubra* A. Nels., by its elongate, prostrate lower branches and small seeds. The following are the only collections seen:

CALIFORNIA: San Diego, 1899, *K. Brandegee* (type); near the Initial Monument, 1898, *K. Brandegee;* Coronado Sand Spit, *Chandler 4011*.

DONDIA Adans.

As treated in the North American Flora, this genus includes twenty species, five of eastern North America, the rest western. Seven species are described as new, three of them known only from Mexico or from barely outside that country. The species of this genus are difficult of determination, and a greater amount of herbarium material, as well as more extensive study in the field, will be necessary to obtain a wholly satisfactory treatment of them, if, indeed, such a treatment is possible. The species described as new seem to the writer to be based upon important differences; certainly they are fully as well marked as most of those heretofore recognized.

DONDIA DEPRESSA (Pursh) Britton; Britt. & Brown, Ill. Fl. **1**: 585. 1896

There seem to be no definite characters by which to separate from this *D. calceoliformis* (Hook.) Rydb. and *D. erecta* (S. Wats.)

* Proc. Amer. Acad. **9**: 125. 1874.

A. Nels. The latter is said, by those who know it in the field, to differ strikingly in its prostrate habit, but in the herbarium no technical differences are discoverable, and the habital differences, of course, are not then apparent.

DONDIA MEXICANA Standley, N. Amer. Fl. **21**: 89. 1916

Most closely related to *D. linearis* (Ell.) Heller, a coastal plant of the West Indies and the eastern and southern United States, being distinguished chiefly by the much smaller seed. The following are the only collections known at present:

SAN LUIS POTOSÍ: Hacienda de Angostura, on alkaline plains, *Pringle 3788* (type). TEXAS: El Paso, June 12, 1895, *Plank*.

DONDIA FRUTICOSA (L.) Druce, List Brit. Pl. 60. 1908

Chenopodina Moquini Torr. Pacif. R. R. Rep. **7**[3]: 18, 1858 (hyponym).

Suaeda intermedia S. Wats. Proc. Amer. Acad. **14**: 296. 1879.

Dondia conferta Small, Bull. N. Y. Bot. Gard. **1**: 280. 1899.

Dondia Moquini A. Nels. Bot. Gaz. **34**: 363. 1902 (hyponym); Abrams, Fl. Los Angeles 131. 1904.

Dondia Wilsonii Millsp. Field Mus. Publ. Bot. **2**: 297. 1909.

The synonyms cited above are only the more important ones based upon North American plants. The most common *Dondia* of the western United States, northern Mexico, the Bahamas and Cuba, the writer is wholly unable to distinguish from the Old World *D. fruticosa*. The West Indian plant seems quite the same as that of the western United States, and the wide distribution in North America seems to make more plausible the specific identity of the Old World and American plants.

The name *D. Moquini*, which has been much used in recent years, is a hyponym, as published by Torrey, for no adequate description was given. Strictly interpreted, the name should be typified by a Cuban specimen cited by Moquin, to which Torrey referred.

DONDIA RAMOSISSIMA Standley, N. Amer. Fl. **21**: 91. 1916

The plants segregated under this name have usually passed as *D. suffrutescens* (S. Wats.) Heller, a species ranging from western Texas

and Chihuahua to Arizona, but they are distinguished by the slender, flexuous branches of the inflorescence and the flat leaves, these usually abruptly contracted at the base and apparently petiolate. The following collections belong here:

CALIFORNIA: Saratoga Springs, *Coville & Funston 304, 305;* Indio, June 10, 1907, *V. Bailey;* Calexico, December, 1901, *J. G. Holmes;* Death Valley, *Coville & Funston 193;* near Bakersfield, *Coville & Funston 1233;* Colorado Desert, 1869, *Palmer.* ARIZONA: Lees Ferry, *Nelson 62* (type). LOWER CALIFORNIA: La Paz, *Nelson & Goldman 7484;* Los Angeles Bay, *Palmer 13;* Seven Wells, Sacatón River, *Schoenfeldt 2887;* Gardners Laguna, *Schoenfeldt 2912.*

DONDIA TAXIFOLIA Standley, N. Amer. Fl. **21**: 91. 1916

The material referred here has been included usually in *D. californica* (S .Wats.) Heller. That species, however, has glabrous stems and leaves, while this is copiously pubescent throughout. The following specimens indicate its range:

CALIFORNIA: Newport, *Davidson 2990*; Santa Barbara, *Eastwood 152;* Long Beach, *Braunton 555;* San Nicholas Island, April, 1897, *Trask;* Playa del Rey, *Abrams 2490* (type); Santa Barbara County, *Torrey 461;* Santa Monica, *Nevin 659.*

DONDIA BREVIFOLIA Standley, N. Amer. Fl. **21**: 92. 1916

This, too, is a segregate from *D. californica,* differing in its copious pubescence. From *D. taxifolia* it is distinguished by the small flowers and much shorter leaves. Collections have been seen as follows:

CALIFORNIA: Newport, *Davidson 1779* (type); Balboa, *Davidson 2952;* San Clemente Island, *Trask 37.* LOWER CALIFORNIA: Agua Verde, *Rose 16601.*

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Phytogeographical notes on the Rocky Mountain Region
VII. Formations in the Subalpine Zone

P. A. RYDBERG

In my Phytogeographical Notes, I have tried to present the distribution of the Rocky Mountain phanerogams viewed from three different standpoints: (1) their zonal distribution, (2) their geographic (provincial) distribution, and (3) their formational distribution. In other words, I have classified the plants: (1) according to the life zone to which they belong; (2) according to their surface distribution, inside as well as outside the Rocky Mountain region; (3) according to the formation to which they belong, i. e., whether they are hydrophytes, or mesophytes, or xerophytes, or any subdivision of these. When I mention formation this should not be taken in a purely ecological sense. In the third paper of the series, "Formations in the Alpine Zone,"* I indicated that I treated the "Formations" purely from a phytogeographical standpoint, and have nowhere treated plant societies, and still two reviewers of my articles (both ecologists) have criticized me for not stating which were the characteristic, the most common, and the secondary species. To do this, when a whole mountain region is treated, is impossible, for in the same class of formations certain species may be the characteristic ones in one locality, while in another they may be only secondary or even lacking altogether.

As shown in the fourth and fifth papers of this series† the vegetation of the Subalpine Zone consists mostly of forests and grasslands. Especially in the Southern Rockies, where the mountain slopes are very steep, another formation is also common, namely, the rock-slides. Where the latter do not exist, the slopes are mostly covered by forest, while the hog-backs and valleys are grasslands.

A. FORESTS

As the forests evidently cover the larger area, they may be treated first. The forest trees are six: *Picea Engelmannii*,

* Bull. Torrey Club 41: 459–474. 1914.

† Bull. Torrey Club 42: 11–18; 629–632. 1915.

Populus tremuloides, *Abies lasiocarpa*, *Pinus aristata*, *Pinus exilis*, and *Pseudots uga mucronata*, of which the last two really belong to the Montane Zone and extend into the lower part only of the Subalpine Zone. Their relative importance, size, and distribution have been treated before.*

The forest formations of the Subalpine Zone in the Rockies may be divided into more or less defined classes, according to the most characteristic trees found there.

1. SPRUCE-BALSAM FOREST

This formation in the Southern Rockies is mostly found on the northern slopes and along water courses. The predominant tree is the Engelmann spruce, *Picea Engelmannii*. Sometimes it is found in pure stand, sometimes mixed with the subalpine fir or balsam, *Abies lasiocarpa*, occasionally also with the aspen. In the lower part of the zone the red fir, *Pseudotsuga mucronata*, is often added. The following species constitute mainly the flora of the spruce-woods, though several more might be added, especially such as are characteristic of the aspen groves, and occasionally accompany the aspen into the coniferous woods.

The corresponding formation in the Northern Rockies resembles that of the Southern very closely, except that *Abies lasiocarpa* becomes more common on the western side, and on the western slope of the Bitter Root Mountains in places becomes the dominant tree. Lyall's larch, *Larix Lyallii*, and the alpine hemlock, *Hesperopeuce Mertensiana*, are added in the Bitter Root Mountains and the Selkirks, and the former in the main Rockies north of latitude 48° 30′. The red fir, *Pseudotsuga mucronata*, scarcely reaches the subalpine region in the Northern Rockies, but the lodge-pole pine, *Pinus Murrayana*, often enters the lower portion of the zone. As stated in a previous paper, *Picea Engelmannii* and *Abies lasiocarpa* are rare in the Big Horn Mountains, and there often the upper limit of the lodge-pole pine constitutes the timber line.

The undergrowth of the spruce-balsam forest in the Northern Rockies is similar to that of the Southern Rockies. Many of the plants are common to both regions, as seen from the following

* Bull. Torrey Club 42: 14–20.

list. The place of the plants limited to the Southern Rockies is taken by those enumerated below. Species in this and subsequent lists which are marked "†" are limited to the Bitter Root-Selkirk region while those marked "‡" are limited to the Canadian Rockies.

Common to the Southern and Northern Rockies

Trees

Picea Engelmannii
Abies lasiocarpa
(*Populus tremuloides*)
Pseudotsuga mucronata (lower portion of the zone only)

Shrubs

Sorbus scopulina
Lepargyrea canadensis
Pachystima myrsinites
Linnaea americana
Distegia involucrata
Gaultheria humifusa
Vaccinium caespitosum
" *oreophilum*
" *scoparium*

Herbs

Poa crocata
Bromus Richardsonii
Vagnera stellata
Disporum trachycarpum
Lysiella obtusata
Ophrys borealis
" *nephrophylla*
Cytherea bulbosa
Alsine baicalensis
Thalictrum sparsiflorum
Atragene tenuiloba
Parnassia fimbriata
Pectianthia pentandra
Ozomelis stauropetala
Micranthes arguta
Tium alpinum
Atelophragma elegans
Aragallus deflexus
Osmorrhiza obtusa
Ligusticum Porteri
Moneses uniflora
Pyrola chlorantha
" *minor*
" *secunda*
Polemonium delicatum
Pedicularis racemosa
Veronica serpyllifolia
Arnica cordifolia
" *Parryi*
" *pumila*

Restricted to the Southern Rockies

Herbs

Anticlea coloradensis
Limnorchis purpurascens
Aquilegia elegantula
Ozomelis stenopetala
" *Parryi*
Viola neomexicana

Conioselinum scopulorum
" *coloradense*
Androsace pinetorum
Castilleja confusa
Adoxa moschatellina
Valeriana ovata
Senecio amplectans

Restricted to the Northern Rockies

Shrubs

Ribes laxiflorum
‡ " *hudsonianum*
" *petiolare*
Azaliastrum albiflorum
Gaultheria ovatifolia
Chiogenes hispudula
Vaccinium occidentale
" *globulare*
Linnaea longiflora

Herbs

‡*Alsine borealis*
Aquilegia columbiana
" *formosa*
Dentaria rupicola
Parnassia palustris
" *Kotzebuei*
Heuchera glabra
†*Pectianthia Breweri*
‡*Ozomelis trifida*
Atelophragma Forwoodii
Aragallus foliolosus
†*Osmorrhiza Leibergii*
Ligusticum filicinum
Moneses reticulata
Pyrola uliginosa
Aster meritus

2. PINE SLOPES

The characteristic tree of this formation in the Southern Rockies is the bristle-cone pine, *Pinus aristata*, which occupies dry slopes and ridges especially on the southern side of the mountains. It seldom forms a dense forest. Occasionally *Picea Engelmannii* or *Populus tremuloides* has encroached on the pine slopes and then the woods are more dense. In the lower part of the zone the bristle-cone pine is often mixed with the limber pine, *Pinus flexilis*. As *Pinus aristata* seldom makes a close stand but grows scattered on the slopes, the undergrowth is mostly made up of the grass formations, either that of the mountain slopes or that of the hog-backs. Wherever the trees stand close the undergrowth contains more and more of the element found in the more open woods. Some of the more common species are: *Arenaria Fendleri, Arnica cordifolia, A. pumila, A. Parryi, Polemonium delicatum, Draba streptocarpa, D. aureiformis, Pseudocymopterus montanus, Solidago*

decumbens, *Poa crocata*, *Festuca saximontana*, *Agropyron Scribneri*, and *Bromus Richardsonii*.

The general feature of the corresponding formation in the Northern Rockies is the same as that just described, but the principal tree of the Southern Rockies, *Pinus aristata*, is not found there. Its place is taken by *Pinus albicaulis*. This tree grows even more scattered and the undergrowth is composed of plants which are still more characteristic of the grass-covered hog-backs. Some of the plants found in the Southern Rockies, as for instance *Pseudocymopterus montanus*, are lacking. *Calamagrostis purpurascens* and *Agropyron latiglume* are rather common. So are also *Xerophyllum tenax* and *X. Douglasii* in places, especially west of the mountains.

3. ASPEN GROVES

The aspen in the Southern Rockies grows mostly on more gentle slopes than the pines, both on the north and south sides of the mountains, especially where the ground is richer and moist. It often takes possession of the ground after the coniferous forest has been destroyed by fire or otherwise. Usually it grows in groves, but sometimes mixed with the spruce, balsam and pines, especially along the edges of woods.

The aspen is not so common in the Northern Rockies, and this is especially true of the Subalpine Zone. In the Montane Zone it grows usually mixed with other species of *Populus*, birches and alders, while in the Subalpine Zone it is found along the edges of the spruce woods, in company with alders and the mountain ash.

The following plants are characteristic of the aspen groves, or else have followed the aspens where they grow mixed with the other trees:

Common to the Southern and Northern Rockies

Trees

Populus tremuloides

Shrubs

Salix brachycarpa
Sorbus scopulina
Distegia involucrata
Vaccinium scoparium

Herbs

Poa crocata
Bromus Richardsonii

Bromus Pumpellianus
Agropyron violaceum
Carex Geyeri
" *Rossii*
" *brunnescens*
Allium brevistylum
Vagnera stellata
Iris missouriensis
Disporum trachycarpum
Coeloglossum bracteatum
Alsine baicalensis
Moehringia macrophylla
Atragene tenuiloba
Anemone globosa
Aquilegia caerulea
Arabis Drummondii
Sieversia arizonica
Lupinus parviflorus
" *pulcherrimus*
Tium alpinum
Atelophragma elegans
Chamaenerion latifolium
Osmorrhiza obtusa
Pyrola uliginosa
" *minor*
" *secunda*
Pedicularis racemosa
" *bracteata*
" *Grayi*
Veronica serpyllifolia
Campanula petiolata
Oreochrysum Parryi
Erigeron Coulteri
" *glabellus*
Anaphalis subalpina
Arnica Parryi
" *pumila*
Achillea lanulosa
Hieracium gracile
Aster Lindleyanus

Restricted to the Southern Rockies

Shrubs

Salix Wolfii
Ribes coloradense
Ribes Wolfii
Sambucus microbotrys

Herbs

Danthonia Parryi
Anticlea coloradensis
Limnorchis purpurascens
Aquilegia elegantula
Draba chrysantha
" *streptocarpa*
Viola neomexicana
Ligusticum Porteri
Pseudocymopterus montanus
Pseudocymopterus sylvaticus
Conioselinum scopulorum
" *coloradense*
Castilleja confusa
Polemonium foliosissimum
Valeriana purpurascens
Antennaria viscidula
Senecio amplectens
" *ambrosioides*

Restricted to the Northern Rockies

Shrubs

‡*Ribes hudsonianum*
" *petiolare*
Ribes laxiflorum
" *glandulosum*

Herbs

Aquilegia columbiana
" *formosa*
Aragallus foliolosus
Hedysarum sulphurascens
Hedysarum Mackenzii
†*Osmorrhiza Leibergii*
Pedicularis contorta
Aster meritus

4. COPSES AND BORDERS OF WOODS

Shrubberies in the Southern Rockies are not common outside of the willow bogs, and the plants gathered together under this heading do not form a distinct formation but a mixture from several, especially of those of the aspen groves, the willow bogs, and the meadows. It consists in reality of the zone of strife between the last one mentioned and the other two. It is therefore not necessary to give a full list of the plants, but only advisable to mention the more common ones.

Copses are more common in the Northern Rockies, especially along the subalpine brooks, where *Alnus sinuata* is the predominant species.

Common to the Southern and Northern Rockies

Shrubs

Salix brachycarpa
Vaccinium scoparium
Distegia involucrata

Herbs

Phleum alpinum
Calamagrostis canadensis
" *Langsdorfii*
Deschampsia atropurpurea
Elymus glaucus
Panicularia nervata
" *pauciflora*
Poa reflexa
" *leptocoma*
" *Olneyi*
Carex Geyeri
" *Rossii*
" *brunnescens*
Veratrum speciosum
Vagnera stellata
Silene Menziesii
Moehringia macrophylla
Draba nitida

Fragaria bracteata
Castilleja rhexifolia
" *lanata*
Erigeron Coulteri
Antennaria anaphaloides
Arnica Parryi
Anaphalis subalpina

Restricted to the Southern Rockies

Shrubs

Salix Wolfii
Acer trifida (Utah)
Sambucus microbotrys

Herbs

Trisetum montanum
Capnoides brachycarpum
Drymocallis fissa
Lathyrus arizonicus
Ligusticella Eastwoodiae
Pseudocymopterus montanus
Oreochrysum Parryi
Cirsium oreophilum
" *Eatonii* (Utah)
" *griseum*

Restricted to the Northern Rockies

Shrubs

‡*Salix Hookeriana*
‡*Ribes glandulosum*
Ribes hudsonianum
Alnus sinuata

Herbs

Silene repens
" *oregana*
Aquilegia columbiana
Sieversia ciliata
Fragaria bracteata
Lupinus monticola
" *caespitosus*
Astragalus spicatus
Homalobus Bourgovii
Hedysarum sulphurescens
" *Mackenzii*
Chaemaenerion angustifolium
" *latifolium*
Senecio pseudaureus
Castilleja Tweedyi
" *lancifolia*

B. GRASSLANDS

The grasslands have been discussed in the fifth paper of the series,* and the grasses were there enumerated. I shall not repeat here the discussion, but merely list the species of plants which enter into the composition of these different formations.

* Bull. Torrey Club 42: 629–634. 1915.

1. MEADOWS

Common to the Southern and Northern Rockies

Muhlenbergia racemosa
" *comata*
Phleum pratense
" *alpinum*
Alopecurus aristulatus
" *occidentalis*
Agrostis asperifolia
" *hyemalis*
" *variabilis*
Calamagrostis Langsdorfii
" *canadensis*
Deschampsia atropurpurea
" *curtifolia*
" *caespitosa*
Trisetum subspicatum
" *majus*
Graphephorum muticum
Danthonia californica
" *intermedia*
Poa pratensis
" *reflexa*
" *leptocoma*
" *alpina*
" *Olneyi*
" *Vaseyana*
Panicularia nervata
" *pauciflora*
Hordeum jubatum
Carex pyrenaca
" *nigricans*
" *eburnea*
" *Preslii*
" *brunnescens*
" *capillaris*
" *albonigra*
" *Reynoldsii*
Carex nova
" *chalciolepis*
" *atrata*
Veratrum speciosum
Juncus parous
" *Mertensianus*
Juncoides parviflorum
" *intermedium*
Lloydia serotina
Bistorta bistortoides
" *linearifolia*
Alsine strictiflora
" *borealis*
" *longifolia*
" *calycantha*
Silene Douglasii
Anemone globosa
Ranunculus alismaefolius
" *micropetalus*
" *eximius*
" *alpeophilus*
" *Eschscholtzii*
Aquilegia caerulea
Aconitum columbianum
" *insigne*
Thlaspi glaucum
Arabis Drummondii
Clementsia rhodantha
Heuchera parviflora
Leptasea Hirculus
Potentilla filipes
" *diversifolia*
" *glaucophylla*
" *decurrens*
" *arachnoidea*
Fragaria glauca

Dasiphora fruticosa
Sieversia ciliata
Acomastylis turbinata
Viola bellidifolia
Primula angustifolia
" *Parryi*
Anthopogon elegans
Amarella scopulorum
" *plebeia*
" *strictiflora*
Dasystephana Romanzovii
Phlox Kelseyi
Myosotis alpestris
Veronica Wormskioldii
Valeriana edulis
Campanula petiolata
Solidago oreophila
Aster Canbyi
Erigeron elatior
" *flagellaris*
" *glabellus*
Erigeron jucundus
" *salsuginosus*
" *superbus*
Antennaria bracteosa
" *corymbosa*
" *microphylla*
" *rosea*
Rydbergia grandiflora
Arnica rhizomata
" *Rydbergii*
Senecio crassulus
" *perplexans*
" *atratus*
" *pseudaureus*
" *pauciflorus*
" *cymbalarioides*
Achillea lanulosa
" *subalpina*
Hieracium gracile
Taraxacum ammophilum
Agoseris aurantiaca

Restricted to the Southern Rockies

Muhlenbergia Wolfii
Agrostis melaleuca
Deschampsia alpicola
Graphephorum Wolfii
Poa callichroa
" *pudica*
" *occidentalis*
" *tricholepis*
Carex bella
" *epapillosa*
Veratrum tenuipetalum
Silene Hallii
Sophia purpurascens
Cheirinia oblanceolata
Draba streptocarpa
" *spectabilis*
Potentilla viridior
Aragallus Parryi
Anthopogon barbellatum
Mertensia pratensis
Besseya plantaginea
Castilleja brunnescens
Campanula Parryi
Pyrrocoma Clementis
Aster griseolus
Erigeron formosissimum
Rydbergia Brandegei
Dugaldia Hoopesii

Arnica macilenta
" *subplumosa*
Senecio pudicus
" *chloranthus*
" *lapathifolius*
Senecio anacletus
" *amplectans*
" *foliosus*
" *multicapitatus*
Agoseris graminifolia

Restricted to the Northern Rockies

Agrostis variabilis
Poa nervosa
Carex ablata
" *montanensis*
" *spectabilis*
Juncoides glabratum
Alsine crassifolia
Silene oregana
" *repens*
" *Douglasii*
‡*Pulsatilla occidentalis*
Ranunculus alismellus
" *saxicola*
" *Suksdorfii*
Aconitum ramosum
‡ " *delphinifolium*
Thlaspi californicum
Heuchera flabellifolia
" *ovalifolia*
Potentilla viridescens
" *glomerata*
" *Vreelandii*
" *flabellifolia*
" *virgultata*
Drymocallis pseudorupestris
Acomastylis sericea
Sieversia ciliata
Lupinus monticola
Trifolium Haydeni
Aragallus viscidulus
" *viscidus*
Epilobium latiusculum
† " *Drummondii*
" *oregonense*
" *anagallidifolium*
Dodecatheon uniflorum
Amarella anisosepala
Phlox alyssifolia
Mertensia paniculata
" *stenoloba*
Pentstemon fruticosum
" *crassifolium*
† " *Lyallii*
Castilleja lutea
" *pallescens*
Adenostegia ramosa
Euphrasia mollis
†*Campanula heterodoxa*
Erigeron politus
Antennaria umbrinella
Arnica tenuis
Senecio megocephalus
" *Hookeri*
" *lugens*
‡*Agoseris pumila*

2. DRY VALLEYS AND BENCHLANDS*

Species marked " § " are found in more sandy places; those

* For description see Bull. Torrey Bot. Club **42**: 632. 1915.

marked "Utah" are restricted within the region of the Southern Rockies to the Wahsatch and Uintah Mountains of Utah.

Common to the Southern and Northern Rockies

Stipa Tweedyi
" *minor*
Poa crocata
" *longiligula*
" *lucida*
" *Buckleyana*
Bromus Porteri
" *Richardsonii*
" *polyanthos*
Agropyron violaceum
Elymus simplex
Carex Hepburnii
" *Engelmannii*
" *occidentalis*
" *obtusata*
" *rupestris*
" *Rossii*
Eriogonum flavum
" *umbellatum*
Cerastium scopulorum
" *strictum*
Alsinopsis Nuttallii (Utah)
Anemone globosa
Pulsatilla ludoviciana
Thlaspi californicum
" *glaucum*
Draba aureiformis
Ivesia Gordonii
Potentilla filipes
" *arachnoidea*
Dasiphora fruticosa
§*Gayophytum racemosum*
Phacelia heterophylla
Pentstemon procerus
Campanula petiolata
Leptodactylum pungens
Chrysopsis asperella
Macronema discoideum
Townsendia incana
Antennaria aprica
" *bracteosa*
" *corymbosa*
" *microphylla*
" *rosea*
Hymenopappus cinereus
Senecio Purshianus
Achillea lanulosa

Restricted to the Southern Rockies

Carex Egglestonii
Eriogonum arcuatum
" *chloranthum*
" *neglectum*
Cerastium variabile
§*Arenaria confusa*
" *globosa*
§*Alsinopsis macrantha*
Lesquerella montana
" *Wardii* (Utah)
Cheirinia lanceolata
Draba Parryi
" *streptocarpa*
" *spectabilis*
" *luteola*
" *brachystylis*

Geranium Pattersonii
Pseudopteryxia longiloba (Utah)
Pentstemon caespitosus
Chrysopsis alpicola
Geranium pumila
Erigeron flagellaris
Senecio Nelsonii
" *Jonesii* (Utah)

Restricted to the Northern Rockies

Eriogonum Piperi
" *polyphyllum*
" *heracleoides*
Spraguea multiceps
Arenaria lithophila
† " *salmonensis*
Arabis exilis
Cogswellia montana
Androsace septentrionalis
Phlox alyssifolia
Erigeron Tweedyi
Antennaria albescens
Lygodesmia juncea

3. MOUNTAIN SLOPES*

Common to the Southern and Northern Rockies

Carex pyrenaica
" *nigricans*
" *Geyeri*
" *pseudoscirpoidea*
" *chimaphila*
Juncus Drummondii
" *Parryi*
Juncoides spicatum
Lloydia serotina
Salix petrophila
" *saximontana*
Cerastium scopulorum
" *strictum*
Anemone globosa
Aquilegia coerulea
Draba nitida
" *crassifolia*
" *Parryi*
" *aureiformis*
" *aurea*
Arabis oblanceolata
" *oreophila* (Utah)
Rhodiola integrifolia
Lithophragma bulbifera
Heuchera flavescens
" *parviflora*
Micranthes arnoglossa
" *rhomboidea*
" *brachypus*
Spathularia Vreelandii
Ivesia Gordonii
Potentilla filipes
" *diversifolia*
" *glaucophylla*
" *divisa*
" *quinquefolia*
" *nivea*
" *saximontana*
Sibbaldia procumbens
Acomastylis turbinata
Homalobus humilis
Epilobium clavatum
" *anagallidifolium*
Angelica Rosei (Utah)

* For discussion see Bull. Torrey Club 42: 632. 1915.

Amarella scopulorum
" *plebeia*
Dasystephana affinis
Polemonium viscosum (Utah)
Phacelia heterophylla
" *alpina* (Utah)
" *sericea*
" *ciliosa*
Mertensia alpina
Pentstemon procerus
Synthyris pinnatifida (Utah)
" *laciniata* (Utah)
Castilleja occidentalis
Valeriana edulis
Campanula petiolata
Solidago ciliosa
" *oreophila*
Aster andinus
" *frondeus*
" *apricus*
Erigeron glabellus
Antennaria anaphaloides
" *aprica*
" *pulcherrima*
" *umbrinella*
Arnica Parryi
" *pumila*
Senecio Nelsonii
" *crocatus*
" *cymbalarioides*
Artemisia spithamaea
" *scopulorum*
" *saxicola*
Taraxacum scopulorum

Restricted to the Southern Rockies

Carex nubicola
Juncus Hallii
Erythronium parviflorum
Salix pseudolapponicum
Cerastium Earlei
" *variabile*
" *oreophilum*
Vahlbergilla Kingi (Utah)
" *montana*
Anemone zephyra
Aquilegia scopulorum
" *thalictrifolia*
Sophia purpurascens
Cheirinia oblanceolata
Draba chrysantha
" *streptocarpa*
" *spectabilis*
" *luteola*
Rhodiola polygama
Germania debilis (Utah)
Potentilla modesta (Utah)
" *tenerrima*
Trifolium Brandegei
" *Parryi*
Pseudocymopterus Tidestromii (Utah)
Angelica Grayi
Primula angustifolia
Polemonium confertum
" *mellitum*
" *Brandegei*
Leptodactylon Nuttallii
Dasystephana Parryi
Phacelia nervosa
Mertensia lateriflora
" *Bakeri*

Mertensia Parryi
Pentstemon stenosepalus
" *caespitosus*
Besseya alpina
" *plantaginea*
" *Ritteriana*
Castilleja puberula
Pedicularis Parryi
" *scopulorum*
Valeriana acutiloba
Solidago decumbens
Oreochrysum Parryi
Aster griseolus
Machaeranthera Pattersonii
Senecio fedifolius
" *petrocallis*
" *ambrosioides*
Artemisia Pattersonii
" *Parryi*
Agoseris agrestis

Restricted to the Northern Rockies

Xerophyllum tenax
" *Douglasii*
Erythronium obtusum
" *grandiflorum*
Salix Seemannii
" *cascadensis*
" *Fernaldii*
Arenaria lithophila
† " *salmonensis*
Silene Lyallii
" *multicaulis*
‡*Sophia sophioides*
Draba cana
Arabis Lyallii
Heuchera grossularifolia
" *flabellifolia*
Micranthes occidentalis
" *saximontana*
" *Rydbergii*
Spathularia Brunnoniana
Potentilla Vreelandii
" *perdisecta*
Drymocallis pseudorupestris
Acomastylis sericea
Sieversia ciliata
Lupinus caespitosus
Trifolium montanense
Cystium platytropis
Viola adunca
Bupleurum americanum
Amarella propinqua
Dasystephana calycosa
" *monticola*
Phacelia Lyallii
Mertensia paniculata
" *stenoloba*
" *Tweedyi*
Pentstemon montanus
" *pseudohumilis*
" *Tweedyi*
Pedicularis Hallii
Valeriana septentrionalis
Campanula heterodoxa
Oreostemma Haydeni
Townsendia Parryi
Antennaria lanata
‡*Artemisia arctica*
" *elatior*
Agoseris pumila

4. HOG-BACKS*

Common to the Southern and Northern Rockies

Carex Hepburnii
" *Engelmannii*
" *occidentalis*
" *phaenocephala*
" *obtusata*
" *rupestris*
" *Helleri*
" *Rossii*
Eriogonum arcuatum
" *flavum*
" *umbellatum*
Oreobroma pygmaea
Silene acaulis
Cerastium Behringianum
Alsinopsis Nuttallii
" *obtusiloba*
Anemone parviflora
" *tetonensis* (Utah)
" *Drummondii*
Pulsatilla ludoviciana
Smelowskia americana
" *lineariloba*
Draba ventrosa
" *oligosperma*
" *andina*
" *crassa*
" *luteola*
" *aurea*
Rhodiola integrifolia
Ivesia Gordonii
Potentilla divisa
" *nivea*
" *uniflora*
" *saximontana*
" *arachnoidea*
Sibbaldia procumbens
Dasiphora fruticosa var.
Trifolium nanum
Androsace carinata
Gilia globularis
Phlox depressa
" *caespitosa*
Eritrichium elongatum
" *argenteum*
Castilleja occidentalis
Erigeron compositus
" *melanocephalus*
" *simplex*
Antennaria aprica
" *media*
" *sedoides*
" *umbrinella*
Chaenactis alpina
Senecio Purshianus
Artemisia scopulorum
" *spithamaea*

Restricted to the Southern Rockies

Eriogonum chloranthum
" *neglectum*
Paronychia pulvinata
Arenaria Fendleri
Thlaspi coloradense
" *purpurascens*

* For discussion see Bull. Torrey Club 42: 633. 1915.

Lesquerella parvula
" *Wardii* (Utah)
Cheirinia nivalis
" *radiata*
" *amoena*
Draba sobolifera (Utah)
" *pectinata*
Ivesia utahensis (Utah)
Potentilla tenerrima
" *minutifolia*
" *paucijuga* (Utah)
Trifolium stenolobium
" *bracteolatum*
" *lividum*
" *dasyphyllum*
Aragallus Hallii
" *oreophilus* (Utah)
Oreoxis humilis
" *Bakeri*
" *alpina*
Phlox condensata
Synthyris pinnatifida
" *laciniata*
Chrysopsis alpicola
Erigeron glandulosus
" *pinnatisectus*
Senecio werneriaefolius
" *Holmii*
" *taraxacoides*
" *Soldanella*

Restricted to the Northern Rockies

Eriogonum Piperi
" *polyphyllum*
" *caespitosum*
" *pyrolaefolium*
Oreobroma minima
Anemone Drummondii
Aquilegia Jonesii
‡*Smelowskia lobata*
† " *ovalis*
Pilosella Richardsoniana
†*Draba eurocarpa*
" *densiflora*
" *lonchocarpa*
Arabis Lyallii
†*Phoenicaulis cheiranthoides*
Coniomitella Williamsii
Heuchera ovalifolia
Potentilla brevifolia
" *Macounii*
" *wyomingensis*
" *ovina*
Trifolium scariosum
Aragallus alpicola
" *viscidus*
" *viscidulus*
Viola adunca
Pseudocymopterus bipinnatus
Bupleurum purpurascens
Douglasia montana
Phlox costata
" *diapensioides*
Synthyris dissecta
" *reniformis*
Townsendia Parryi
" *florifer*
Oreostemma Haydeni
Erigeron radicatus
" *Scribneri*
" *Tweedyi*
Antennaria acuta
" *mucronata*
" *pulvinata*
‡*Tonestus laceratus*

C. VARIOUS HYDROPHYTIC FORMATIONS

These consist of bogs, brook banks, lakes, ponds, and brooks. In the Subalpine Zone these contain few grasses and no trees. The bogs may be divided into sedge bogs, willow bogs and *Sphagnum* bogs.

1. SEDGE BOGS

The sedge bogs resemble those of the Alpine Zone. These have already been described in a previous paper.*

Common to the Southern and Northern Rockies

Alopecurus aristulatus
Calamagrostis Langsdorfii
Poa reflexa
Phleum alpinum
Panicularia pauciflora
Carex nigricans
" *gymnocrates*
" *disperma*
" *aurea*
" *brunnescens*
" *Reynoldsii*
" *nova*
" *bella*
" *aquatilis*
Scirpus pauciflorus
" *caespitosus*
Eriophorum angustifolium
" *gracile*
Juncus balticus montanus
" *triglumis*
" *castaneus*
" *Mertensianus*
Bistorta bistortoides
" *linearifolia*
" *vivipara*
Alsine longifolia
" *strictiflora*
Alsine laeta
" *crassifolia*
" *calycantha*
Thalictrum alpinus
Ranunculus affinis
Ranunculus eximius
Trollius albiflorus
Aconitum columbianum
Radicula alpina
Parnassia fimbriata
Micranthes arguta
Geum rivale
Epilobium ovatifolium
" *Drummondii*
" *wyomingense*
Hippurus vulgaris
Pyrola uliginosa
Primula Parryi
Anthopogon elegans
Amarella scopulina
" *strictiflora*
Dasystephana Romanzovii
Pleurogyne fontana
Swertia scopulina
" *congesta*
Myosotis alpestris
Veronica americana

* See Bull. Torrey Club 41: 471, 472, 1914.

Veronica Wormskjoldii
Elephantella groenlandica
Mimulus Langsdorfii
Senecio crassulus
Erigeron salsuginosus

Restricted to the Southern Rockies

Juncus parous
Ranunculus alismaefolius
" *micropetalus*
" *stenolobus*
Caltha rotundifolia
Aconitum Bakeri
" *insigne*
Radicula curvipes
" *Underwoodii*
Epilobium stramineum
Ligusticum Porteri
Senecio atratus
" *lapathifolius*

Restricted to the Northern Rockies

Alopecurus occidentalis
Poa leptocoma
Carex saxatilis
Eriophorum Scheucheri
" *Chamissonis*
‡ " *alpinus*
Tofieldia intermedia
Juncus Regelii
" *nevadensis*
Ranunculus alismellus
" *Suksdorfii*
" *Helleri*
Caltha leptosepala
Aconitum ramosum
‡ " *delphinifolium*
Cardamine umbellata
Cardamine acuminata
Parnassia palustris
" *Kotzebue*
Comarum palustre
Argentina subarctica
‡*Epilobium oregonense*
" *wyomingense*
" *latiusculum*
Pedicularis contorta
" *ctenophora*
" *lunata*
" *Hallii*
" *Canbyi*
" *bracteosa*
" *cystopteridifolia*
Petasites corymbosa

2. WILLOW BOGS

The characteristic vegetation of these consists of shrubby species of *Salix* and *Betula glandulosa*. The herbaceous flora contains most of the plants of the sedge bogs. The shrubs present are the following:

Southern Rockies

Salix Wolfii
" *brachycarpa*
Salix pseudolapponum
" *glaucops*

Salix chlorophylla
Betula glandulosa
Phyllodoce empetriformis
Kalmia microphylla
Distegia involucrata

Northern Rockies

Salix Barkleyi
" *commutata*
" *Tweedyi*
" *pseudomyrsinites*
" *chlorophylla*
Alnus sinuata
Ledum glandulosum
†*Azaliastrum albiflorum*
Phyllodoce glanduliflora
" *empetriformis*
Andromeda polifolia
Vaccinium uliginosum

In the Canadian Rockies quite a number of subarctic willows and other shrubs are added to this flora. These species, which are listed below, grow either in the willow bogs proper or on wet mountain slopes.

Salix Hookeriana
" *myrtillifolia*
" *alaxensis*
" *Barrettiana*
" *Drummondiana*
Salix turbusculoides
" *Seemannii*
" *desertorum*
Ledum groenlandicum
Vaccinium Vitis-Idaea

3. SPHAGNUM BOGS

Sphagnum bogs are exceedingly rare in the Southern Rockies and of very limited extent. The phanerogamic flora, if any, is not different from that of the other bogs. In the northern part of the Northern Rockies, especially in Canada, they are more common. Here, as well as in the northern parts of Montana and Idaho, there are found several phanerogams characteristic of the Hudsonian Zone of the northeast. Among these may be mentioned:

Eriophorum angustifolium
" *Chamissonis*
" *alpinum*
Drosera rotundifolia
" *longifolia*
Thalictrum alpinum
Rubus acaulis
" *arcticus*
" *Chamaemorus*
Oxycoccus palustris
Pinguicula vulgaris

4. BROOK BANKS

Many of the brook banks are lined with willows and *Betula glandulosa* or with sedges. In such cases the flora is practically the same as that of the willow bogs or sedge bogs. In the subalpine regions of the Rockies, we find also another brook bank flora, consisting of herbaceous plants which are neither sedges nor grasses, and which are rarely found in the bogs proper. Brook banks of this type are found mostly where the slope is steep and the valley narrow, so that neither swamps nor grasslands could exist. The characteristic plants of these brook banks are mostly species of *Mertensia*. *Epilobium* and *Juncoides*, and where it is drier we find *Cirsium*.

Common to Southern and Northern Rockies

Poa reflexa
Panicularia nervata
Calamagrostis canadensis
Juncus balticus montanus
Juncoides parviflorum
" *spicatum*
Delphinium occidentale
Alsine longifolia
" *borealis*
Epilobium ovatum
Epilobium stramineum
" *wyomingense*
Mimulus Langsdorfii
Mertensia pratensis
" *ciliata*
" *viridula*
Veronica americana
Arnica rhizomata
Senecio triangularis

Restricted to the Southern Rockies

Juncoides subcapitatum
Delphinium Barbeyi
" *attenuatum*
Oxypolis Fendleri
Castilleja brunnescens
Cirsium Parryi
" *scopulorum*
" *oreophilum*

Restricted to the Northern Rockies

Poa leptocoma
Juncoides glabratum
‡*Anemone Richardsonii*
Mertensia paniculata
" *stenoloba*
Senecio saliens
Chamaenerion latifolium

In the more open places where the taller herbs have not crowded out the smaller ones, the flora consists of the following species:

Common to Southern and Northern Rockies

Poa alpina
Carex bella
" *calciolepis*
" *atrata*
Scirpus pauciflorus
Juncus triglumis
Juncoides spicatum
Alsine baicalensis
" *laeta*
Alsinopsis propinqua
Sagina saginodes
Ranunculus alpeophilus
Ranunculus Eschscholtzii
Saxifraga cernua
" *debilis*
Chrysosplenium tetrandum
Micranthes arnoglossa
Muscaria delicatula
Androsace subumbellata
" *filiformis*
Condrophylla americana
Pleurogyne fontana
Veronica Wormskjoldii

Restricted to the Southern Rockies

Alsine polygonoides
Condrophylla Fremontii

Restricted to the Northern Rockies

‡*Juncoides arcticum*
‡ " *hyperboreum*
‡ " *arcuatum*
Neiocrene parvifolia
Micranthes Lyallii
" *Brunnonianum*
Hemiera ranunculifolia
Epilobium saximontanum
" *anagallidifolium*
" *clavatum*
Romanzoffia sitchensis
" *Leibergii*

5. LAKES, PONDS AND BROOKS

The purely aquatic flora is not well represented in the Subalpine Zone. It contains practically the same species as are in the Alpine Zone with few additions from the Montane Zone.* The following species belong to this formation:

Common to the Southern and Northern Rockies

Sparganum minimum
" *angustifolium*
Potamogeton alpinus
Catabrosa aquatica
Carex aquatilis
Veronica americana
Utricularia vulgaris
" *minor*
Nymphaea polysepala
Hippuris vulgaris
Lemna gibba
" *minor*

* Compare discussion in Bull. Torrey Club **41**: 473, 474; **43**: 630.

Restricted to the Northern Rockies

Batrachium confervoides — *Lobelia Dortmanna*
Veronica scutellata

D. MISCELLANEOUS FORMATIONS

1. ROCK-SLIDES

The rock-slides in the Subalpine Zone* resemble those in the Alpine Zone, and the flora is practically the same with a few additions, as shown by the following lists:

Common to the Southern and Northern Rockies

Selaginella densa
Oxyria digyna
Claytonia megarrhiza
Macronema discoideum

Restricted to the Southern Rockies

Allium Pikeanum
Aquilegia saximontana
Telesonix Jamesii
Heuchera Hallii
Ribes montigenum
Viola biflora
Pseudopteryxia anisata
Primula Parryi
Polemonium Grayanum
" *speciosum*
" *confertum*
" *Brandegei*
Polemonium delicatum
Pentstemon Hallii
" *Harbourii*
" *stenosepalus*
Syntheris plantaginea
Machaeranthera Pattersoni
Senecio Holmei
" *Soldanella*
" *Harbourii*
" *cathamoides*
Senecio invenustus

Restricted to the Northern Rockies

Alsine americana
Telesonix heucheriforme
Ribes parvulum
Pseudopteryxia Hendersonii
Collomia debilis
Polemonium viscosum
Hulsea carnosa
Senecio Fremontii

2. BARE CLIFFS

The flora of the crevices of the bare cliffs is practically the same as that of similar habitats in the alpine region. The species there have already been listed but are again enumerated below.†

* See Bull. Torrey Club 41: 465. 1914.
† See Bull. Torrey Club 41: 466. 1914.

Common to the Southern and Northern Rockies

Chondrosea Aizoon
Leptasea austromontana
Antiphylla oppositifolia
Oxyria digyna

Restricted to the Southern Rockies

Anticlea coloradensis
Aquilegia saximontana
Polemonium pulcherrimum
Polemonium delicatum
Edwinia macrocalyx (Utah)
Senecio petrocallis

3. TALUS

In many places, under the perpendicular cliffs, there have gathered rather steep slopes of talus. Where this consists of larger rocks, the flora is the same as that of the rock-slides, but where it consists of small fragments and especially where there is a certain moisture, this talus has been taken possession of by certain plants, which can be regarded as forming a distinct formation. The most common of these plants are:

Common to the Southern and Northern Rockies

Carex Geyeri
Juncus Drummondii
" *Parryi*
Alsine laeta
Anemone tetonensis
Epilobium alpinum
" *Hornemannii*

Restricted to the Southern Rockies

Anticlea coloradensis

Restricted to the Northern Rockies

Viola flavovirens

NEW YORK BOTANICAL GARDEN

Fruit bud formation—a criticism

J. H. GOURLEY

(WITH ONE TEXT FIGURE)

Early in 1915, I wrote as follows in Technical Bulletin No. 9, New Hampshire Experiment Station:

> Writers in the eastern United States have commonly made the statement that fruit buds are never axillary in the apple such as occurs in the northwest, yet this method of producing fruit buds in the east is not uncommon. It has been observed by the writer throughout the eastern states on both old and young trees and with many varieties. Whether it has any significance or not, it might be noted that it was more common in the plot fertilized with an excess of nitrogen fertilizer than elsewhere in the orchard. While from a practical standpoint this method of fruit-bud production can be almost ignored, it is well worthy of record.

This position has been controverted by O. Butler in the Bulletin of the Torrey Botanical Club (**44**: 85–96. 1917), as follows:

> A *fruit branch* is a leader in which the terminal and axillary buds in the upper two thirds or thereabouts of its length become flower buds during the season of its development (PLATES I, FIG. 2, and 2). The flower buds borne laterally on the leader have been described as formed axillarly by D'Albret and by Gourley, though they are in reality borne terminally on almost sessile spurs (*lambourdes*). A close study during the first season of the buds from which the supposed axillary clusters arise will show that at the close of vegetation the buds are subtended by a rosette of leaves and are not in the axil of a single leaf. The buds are, therefore, terminal on sessile spurs and not axillary, as by definition an axillary bud is a bud borne in the axil of a leaf. Forney is also of this opinion for he states that "it often happens that the eyes of this season's leader become transformed at once into spurs, and flower perfectly the following year." In the apple the development of flower buds on fruit branches is not commonly met with and is said to occur only in very fertile trees, or trees weakened by transplantation or soil exhaustion.

I have recently reëxamined material in our orchards and again find that fruit buds are formed as true axillary buds in abundance on many trees (see FIG. 1). Occasionally short spurs are formed on new growth as I think horticulturists were aware, but in no such abundance as the axillary buds. It is likely that Butler mistook the points of attachment of the larger bud scales for leaf scars as they resemble them somewhat after the blossom cluster has been out a short time. I am led to suggest this explanation as the

plates which he shows are illustrations of true axillary flower buds and not spurs as indicated in his text.

Practically the same statement is found in Technical Bulletin No. 10, New Hampshire Experiment Station, by Miss C. A. Black, which adds to the importance of having the matter corrected. In the latter article the author states that "the few scars at the base of this inflorescence indicate that it is really terminal and not axillary." This would indicate that proper material was not at hand for examination, for where axillary flower buds are formed it is impossible to see more than the one large leaf scar and there is no possible point of attachment for other leaves to be found. Her statement that "such buds are few in number and of no vigorous growth" is also an error, although they often do "develop later than the usual terminal flower buds." A wrong interpretation is furthermore given of *pl. 33, f. 2*, of this bulletin. I would consider this figure to represent a two-year-old shoot and not a three-year-old one, for it is common to find a shoot develop from the flower cluster and develop as shown in this figure. In fact two such shoots often are found on the spur with an apple developing also.

FIG. 1. Axillary flower buds on the Wealthy apple.

In observing wild species of *Pyrus* and *Malus* at the Arnold Arboretum I have found the following list to form fruit buds in the axils of the leaves rather profusely:

Malus pumila Niedzwetzkyana Schneid.
M. pumila apetala Schneid.
M. baccata Borkh.
M. baccata Jackii Rehd.
M. baccata mandshurica Schneid.
M. baccata sanguinea Hort.
M. baccata aurantiaca Hort.
M. Soulardi Britt. (*M. ioensis* × *M. pumila*)

M. astrachanica Dum.-Cours (*M. baccata* × *M. pumila*)
M. Sargentii Rehd.
M. prunifolia Borkh.
M. prunifolia Rinki Rehd.
M. zumi Rehd.
M. micromalus Makino *baccata* × *M. spectabilis*)
M. theifera Rehd.
M. Sieboldii Rehd. *calocarpa* Rehd.
M. cerasifera Spach (*M. baccata* × *M. pumila*)
M. floribunda Sieb.
M. Arnoldiana Rehd. (*M. baccata* × *M. floribunda*)
M. spectabilis Borkh.
M. Scheideckeri Zabel (*M. floribunda* × *prunifolia*)
(*M.M. Halliana* Koehne

Pyrus ovoidea Rehd.
P. phaeocarpa Rehd.
P. betulaefolia Bge.
P. Bretschneideri Rehd.

This would indicate a tendency for original species to flower as above described, although in our cultivated varieties of *Malus pumila* Mill. the spur system of flowering is the common method and the axillary formation can be ignored as of no special commercial importance. It is of some interest to note that none of our American species of *Malus*, such as *M. coronaria*, *M. ioensis* and *M. augustifolia*, showed axillary flower buds, although the trees were blooming full. Whether this is always true, I cannot state.

AGRICULTURAL EXPERIMENT STATION,
DURHAM, NEW HAMPSHIRE

INDEX TO AMERICAN BOTANICAL LITERATURE

1914-1917

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers at the rate of one cent for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card issue should be addressed to the Treasurer of the Torrey Botanical Club.

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